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(54) **COMPOSITION NUTRITIONNELLE A HAUTE VALEUR
ENERGETIQUE**

(54) **HIGH ENERGY NUTRITIVE COMPOSITION**

(57) L'invention concerne un complément alimentaire diététique à haute teneur en énergie. Ce complément contient une matière grasse hydrolysée au moins partiellement et lui apportant entre 40 % environ et 55 % environ de son contenu énergétique total. De préférence, le complément contient également, un ou plusieurs émulsifiants non toxiques. La matière grasse est, de préférence, de la matière grasse de lait partiellement hydrolysée. Le complément peut également contenir d'autres ingrédients alimentaires usuels, tels qu'une source d'hydrates de carbone, un modificateur de texture, des édulcorants et des agents aromatisants. Le complément peut se présenter sous forme liquide, semi-solide ou solide. Il est plus particulièrement destiné aux sportifs s'adonnant à des disciplines d'endurance.

(57) High energy dietary supplements which include fat which is at least partially hydrolysed and in which about 40 % to about 55 % of the total energy of the supplement is provided by the fat. The supplements preferably also include one or more non-toxic emulsifiers. The fat is preferably partially hydrolysed milk fat. The supplements also optionally contain other conventional nutritive components such as a carbohydrate source, a texture modifier, sweeteners and flavouring agents. The supplements may be provided either in liquid, semi-solid or solid form, and are believed to be particularly suitable for consumption by endurance athletes.



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(54) Title: HIGH ENERGY NUTRITIVE COMPOSITION			
(57) Abstract			
<p>High energy dietary supplements which include fat which is at least partially hydrolysed and in which about 40 % to about 55 % of the total energy of the supplement is provided by the fat. The supplements preferably also include one or more non-toxic emulsifiers. The fat is preferably partially hydrolysed milk fat. The supplements also optionally contain other conventional nutritive components such as a carbohydrate source, a texture modifier, sweeteners and flavouring agents. The supplements may be provided either in liquid, semi-solid or solid form, and are believed to be particularly suitable for consumption by endurance athletes.</p>			

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HIGH ENERGY NUTRITIVE COMPOSITION

5 TECHNICAL FIELD

This invention relates to high energy dietary supplements, which are particularly suitable for consumption by endurance athletes.

10 BACKGROUND ART

High carbohydrate diets are widely recommended to endurance athletes since they are believed to enhance physical performance (Costill, D, Am J Clin Nutr 34: 1831-1836 (1982)). The energy expenditure involved in training and competing for endurance and
15 ultra endurance events (events greater than 90 minutes and between 4 and 24 hours respectively) can be so great (22.9-75.2 MJ/day or 5,500 to 18,000 kcal/day (Kreider, R B, Int J Sports Nutr 1:3-27 (1991)) that many athletes find difficulty in complying with this recommendation unless large quantities of extrinsic sugars are consumed. For these reasons the most popular liquid nutrition formulae commercially available to
20 athletes are composed predominantly of carbohydrate.

A diet relatively high in fat provides an alternative means of achieving a high intake of energy. However high fat diets are not recommended to endurance athletes because high carbohydrate intakes are considered necessary to achieve maximum glycogen
25 stores and because previous studies have reported gastrointestinal distress (Rehrer, N, Int J Sports Nutr 2: 48-59, 1992) during exercise after consumption of high fat foods.

This justification is not soundly based since few studies have reliably compared the effects of dietary intake on performance and since previous studies reporting gastrointestinal distress after high fat food consumption have tested traditional high fat
30 solid foods and concentrated medium-chain-triglyceride (MCT) solutions.

The applicants have successfully trialed a high-fat high-energy dietary supplement in a group of endurance-trained road cyclists. The applicants have found that the gastrointestinal distress previously associated with exercising after traditional high fat
35 foods can be overcome. Furthermore endurance capacity after consumption of the high energy dietary supplement was not compromised.

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It is this high-fat high-energy dietary supplement which is the focus of the present invention.

SUMMARY OF THE INVENTION

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Accordingly, in a first aspect the present invention may broadly be said to consist in a high energy dietary supplement which includes fat which is at least partially hydrolysed and wherein from about 40% to about 55% of the total energy of the supplement is provided by the fat.

10

Preferably, the dietary supplement includes one or more non-toxic emulsifiers.

Most conveniently, the fat comprises partially hydrolysed milk fat.

15 Preferably the milk fat is partially hydrolysed anhydrous milk fat.

The dietary supplement will also include other conventional nutritive components such as a carbohydrate source, texture modifiers, sweeteners and flavouring agents to enhance palatability.

20

The high energy dietary supplement can be provided in the form of a solid, a semi-solid or a liquid.

In one preferred form of the invention, the dietary supplement is in the form of a liquid.

25

Preferably, in this form of the invention, the emulsifiers are a mixture of monoacetyl and diacetyl tartaric acid ester of mono/diglycerides, glycerol monostearate, lecithin and concentrated medium chain triglycerides.

30 Preferably, the emulsifiers are present in the following relative amounts:
about 65.2% concentrated medium chain triglycerides, about 17.4% glycerol monostearate, about 13.0% monoacetyl and diacetyl tartaric acid ester of mono/diglycerides and about 4.3% lecithin.

35 Preferably, the emulsifiers are present in a combined amount of about 35.4% by weight of the partially hydrolysed anhydrous milk fat (or about 26.1% of the combined weight of the emulsifiers and partially hydrolysed anhydrous milk fat).

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Preferably, the emulsifiers and the partially hydrolysed anhydrous milk fat are present in combined amount of about 8.8% by weight of the supplement.

5 In this form of the invention, the liquid high energy dietary supplement preferably further comprises water, maltodextrin, fructose, milk protein isolate, sodium citrate, maltol and a flavouring component.

Preferably, the supplement has the following formulation:

10	<u>Component</u>	<u>% By Weight of Total Composition</u>
	maltodextrin (Maltrin M200)	about 9.0%
	fructose	about 6.8%
	milk protein isolate (TMP1180)	about 5.0%
	sodium citrate	about 0.4%
15	partially hydrolysed milk fat plus emulsifiers	about 8.8%
	maltol	about 0.1%
	flavour	about 0.4%
	water	about 69.5%

20

In another preferred embodiment of the invention, the supplement is in the form of a dry drink base suitable for addition to a liquid (such as water or milk).

25 In yet another preferred embodiment of the invention, the supplement is in the form of a solid, preferably a snack bar.

Preferably, in this form of the invention, the emulsifier is glycerol monostearate, which preferably has a residual soap content of about 2%.

30 Preferably, the emulsifier is present in an amount of about 26.4% by weight of the partially hydrolysed anhydrous milk fat (or about 20.9% of the combined weight of the glycerol monostearate and the partially hydrolysed anhydrous milk fat).

35 Preferably, the partially hydrolysed anhydrous milk fat is present in an amount of about 20.24% by weight of the snack bar.

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Preferably, the glycerol monostearate is present in an amount of about 4.7% to about 6.9% by weight of the snack bar.

- 5 In this form of the invention, the high energy dietary supplement preferably further comprises fructose, glucose syrup, whey proteins, modified starch, water, maltodextrin, sodium citrate, citric acid, carrageenan, calcium citrate, maltol and flavour.

- 10 Preferably, the snack bar comprises the following components in the proportions set out below:

	<u>Component</u>	<u>% (By Weight)</u>
	fructose	about 17.0% to about 22.09%
	glucose syrup	about 20.5% to about 21.06%
15	partially hydrolysed anhydrous milk fat	about 20.24%
	whey protein (Alacen 152)	about 10.0% to about 10.6%
	modified starch (TB 840)	about 5.0% to about 7.2%
	whey protein (Alacen 312)	about 6.2% to about 6.4%
20	glycerol monostearate	about 4.7% to about 6.9%
	water	about 3.29%
	maltodextrin (Maltrin M100)	about 2.0% to about 4.4%
	sodium citrate	about 0.3% to about 1.0%
	citric acid	about 0.2% to about 0.5%
25	carrageenan	about 0.1% to about 1.0%
	maltol (Veltol)	about 0.15%
	calcium citrate	about 0.05% to 0.16%
	vanilla flavour	about 0.3% to about 0.8%

- 30 Preferably, the snack bar has the following formulation:

	<u>Component</u>	<u>% (By Weight)</u>
	fructose	about 22.09%
	glucose syrup	about 21.06%
35	partially hydrolysed anhydrous milk fat	about 20.24%
	whey protein (Alacen 152)	about 10.27%

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	modified starch (TB 840)	about 6.99%
	whey protein (Alacen 312)	about 6.37%
	glycerol monostearate	about 5.34%
	water	about 3.29%
5	maltodextrin (Maltrin M100)	about 2.26%
	sodium citrate	about 0.62%
	citric acid	about 0.41%
	carrageenan	about 0.41%
	maltol (Veltol)	about 0.15%
10	calcium citrate	about 0.08%
	vanilla flavour	about 0.41%

DETAILED DESCRIPTION OF THE INVENTION

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Preferred forms of the present invention will now be described in more detail.

20 The high energy dietary supplements of the present invention contain fat as an essential component. This fat must also meet two essential criteria. First, it must be partially hydrolysed. By this it is meant that the fat component cannot be entirely in the form of triglycerides. There must be at least some diglycerides or monoglycerides (and preferably both) present. It is also preferred that some free fatty acids are present in the partially hydrolysed fat, and that the free fatty acids are preferably in the form of salts, such as sodium salts. Therefore, as used herein, the term "partially hydrolysed fat" means any fat which comprises a mixture of triglycerides with diglycerides and/or monoglycerides, whether or not obtained by a process in which partial hydrolysis of triglycerides has actually been effected.

30 The second essential criterion is that the fat must be present in the supplement in an amount sufficient to provide from about 40% to about 55%, more preferably about 48% to about 50%, of the total energy of the supplement. It is believed by the applicants that within this range, the partially hydrolysed fat will provide sufficient energy to sustain an athlete ingesting a relatively small amount of material, while at the same time allowing the supplement to remain palatable and, with the assistance of the other components of the supplement, quickly digestible. The total energy of the supplement, and the proportion contributed by the fat, may be measured using standard techniques, such as bomb calorimetry to obtain an experimental estimate of energy, or Atwater conversion figures to obtain a theoretical value based on the proportion of fat,

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carbohydrate and protein present: fat contains about 37 kJ/g, carbohydrate about 16 kJ/g, and protein about 17kJ/g.

5 It is also most preferred that the dietary supplements of the present invention contain one or more non-toxic emulsifiers. The emulsifier(s) can either be added separately to other components of the dietary supplement, or can instead first be incorporated into the partially hydrolysed fat, for subsequent addition to other components of the dietary supplement.

10 The fat can be from any source appropriate for use in a dietary product. It can be fat from a single source or from a combination of sources. It is however preferred that the fat comprises partially hydrolysed milk fat. It is particularly preferred that the milk fat is anhydrous milk fat.

15 The dietary supplements of the invention will also include other conventional nutritive components such as a carbohydrate source, texture modifiers, sweeteners and flavouring agents to enhance palatability. The dietary supplements may also include a suitable antioxidant, such as Vitamin E, butylated hydroxy toluene or butylated hydroxy anisole.

20 The dietary supplement of the present invention can be provided in many forms - solid, semisolid or liquid. For example, the dietary supplement may be provided in the form of a liquid, as a ready to drink supplement. It may also be provided in a dried form, such as a powder or granules, suitable for reconstitution as a drink by addition to a
25 liquid such as water or milk. Alternatively, the dietary supplement may be in the form of a solid, such as a snack bar.

Partially hydrolysed fat

30 The preferred high energy dietary supplements according to the present invention may be prepared by first obtaining partially hydrolysed fat. The partially hydrolysed fat can be obtained from any source, including a commercial source if available. It can also be specifically produced for preparation of the dietary supplements of the invention by
35 any suitable hydrolysis process. Where, as is preferred, the fat is milk fat, the partially hydrolysed fat may conveniently be prepared by heating milk fat, in the presence of a suitable base, for a sufficient time and at a suitable temperature to bring about partial

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hydrolysis of the milk fat, that is, to remove esterified fatty acids from the glycerol backbone of the triglycerides.

5 Milk fat contains a high proportion of medium and short chain fatty acids, including butyric acid. It is preferred that the hydrolysis conditions are such as to avoid the selective removal of butyric acid from the milk fat triglycerides, in order to prevent the partially hydrolysed fat having an offensive odour of butyric acid. The hydrolysis conditions, therefore, are preferably chosen so to minimise the release of butyric acid with respect to the total degree of hydrolysis.

10

It is particularly preferred that the milk fat is anhydrous milk fat, and that this is heated to about 85°C. Sodium hydroxide may conveniently be used to hydrolyse the milk fat, and is generally added in an amount of about 0.4% by weight. It has been found that a reaction time of about 6-7 hours, preferably about 6.5 hours, will bring about a desirable level of partial hydrolysis of the milk fat. These reaction conditions have been found to effect minimal release of butyric acid.

15

After the partial hydrolysis has taken place, the hydrolysate is usually filtered to remove unreacted sodium hydroxide, and neutralised to about pH 7, with a suitable non-toxic acid. It is preferred that lactic acid is used, preferably at least about 88% by weight lactic acid, but other suitable acids will be apparent to those skilled in the art.

20

Products

25

Various embodiments of the invention are described in more detail below. In all of these embodiments, the fat is partially hydrolysed anhydrous milk fat.

1. Liquid supplement suitable for people with lactose intolerance

30

In one preferred embodiment of the invention, the dietary supplement is a liquid supplement, which is suitable for consumption by people having lactose intolerance.

35

A presently preferred emulsification system for this liquid dietary supplement consists of a mixture of monoacetyl and diacetyl tartaric acid ester of mono and diglycerides, glycerol monostearate, lecithin and concentrated medium chain triglycerides, although other suitable non-toxic emulsifiers will be apparent to those skilled in the art. It is also preferred that these preferred emulsifiers are present in the following proportions

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(relative to the total amount of emulsifier): about 65.2% concentrated medium chain triglycerides, about 17.4% glycerol monostearate, about 13.0% monoacetyl and diacetyl tartaric acid ester of mono/diglycerides, and about 4.3% lecithin. The monoacetyl and diacetyl tartaric acid esters of mono/diglycerides preferably contain
5 27-30% total tartaric acid and 21-23% total acetic acid, and are referred to as Datem. A suitable source of these is that known as Lamegin DW 8000 (which contains 80% Datem and 20% tricalcium phosphate as an anti-caking agent).

The concentrated medium chain triglycerides, as well as having some emulsification
10 properties, improve get-away of the dietary supplement by further lowering the average melting point of the fat. This assists in reducing mouth coating. In addition, medium chain triglycerides are metabolised via a different pathway than normal triglycerides and provide a more rapid source of energy. A preferred concentrated medium chain triglyceride blend contains approximately 30% capric acid and
15 approximately 70% caprylic acid.

The emulsifiers are preferably present in a combined amount of about 35.4% by weight of the partially hydrolysed anhydrous milk fat (or about 26.1% of the combined weight of the emulsifier and partially hydrolysed anhydrous milk fat). It is also preferred that
20 the partially hydrolysed anhydrous milk fat incorporating the emulsifiers is present in an amount of about 8.8% by weight of the dietary supplement.

The additional components of the liquid composition are preferably maltodextrin (preferably in an amount of about 9.0% by weight of the liquid composition), milk
25 protein isolate (preferably in an amount of about 5.0 % by weight), sodium citrate (preferably in an amount of about 0.4% by weight), maltol (preferably in an amount of about 0.1% by weight), flavour (preferably in an amount of about 0.4% by weight) and water (preferably in an amount of about 69.5% by weight). Although by no means essential, it is preferred that the maltodextrin used is Maltrin M200 (dextrose
30 equivalent 20), as this has been found to provide a superior mouth feel to Maltrin M100 (dextrose equivalent 10) and Maltrin M050 (dextrose equivalent 5).

The milk protein isolate assists in emulsification of the fat. A preferred milk protein isolate is the product known as TMP1180, which is a spray dried soluble protein,
35 containing both whey proteins and casein (as a caseinate). It is highly soluble, with good emulsifying properties and water binding properties. It has a typical composition as follows: 92.0% w/w protein (as is), 3.6% w/w ash, and 4.1%w/w moisture.

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A dietary supplement according to the above formulation is believed to be suitable for use as a ready-to-drink product, for example as a UHT drink.

5 2. Liquid supplement containing lactose

In an alternative embodiment of the invention, the dietary supplement is also in the form of a liquid. However, in this embodiment, the additional components are preferably whole milk (preferably present in an amount of about 77%-83% by weight), skim milk powder (preferably in an amount of about 7.3%-8.3% by weight), fructose (preferably in an amount of about 3.9%-4.1% by weight), cocoa (preferably in an amount of about 0.95%-1.95% by weight), cocoa flavour (preferably in an amount of about 0.75% by weight), sodium citrate (preferably in an amount of about 0.60% by weight), and carboxy methyl cellulose (preferably in an amount of about 0.30% by weight). In this embodiment of the invention, the partially hydrolysed anhydrous milk fat and the emulsifier are preferably together present in a combined amount of about 5%-6%, more preferably about 5.1% by weight of the dietary supplement.

20 3. Dried drink base formulation

In an alternative embodiment of the invention, the dietary supplement is provided in a dry form, such as a powder or granules, as a drink base. Such a drink base may consist of a liquid formulation according to the present invention, such as the formulations described immediately above, which has been dried (for example, spray dried). Alternatively, such a drink base may consist of a mixture of partially hydrolysed fat and other, dry ingredients, which has been prepared by simply mixing these ingredients together. The drink base is reconstituted with a suitable liquid such as water or milk, to provide the dietary supplement in ready-to-drink form.

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4. Snack bar

In other preferred embodiments of the invention, the high energy dietary supplements of the present invention are in the form of a solid, the partially hydrolysed milk fat being incorporated, for example, into a snack bar.

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- 10 -

In this embodiment of the invention, it is preferred that the partially hydrolysed milk fat (excluding emulsifier) is present in an amount of about 20.24% by weight of the snack bar. It is particularly preferred that the emulsifier is present in an amount of about 26.4% by weight of the partially hydrolysed milk fat (or about 20.9% of the combined weight of the glycerol monostearate and partially hydrolysed milk fat).

In this embodiment, the preferred emulsifier is glycerol monostearate, which has a hydrophilic lipophilic balance (HLB) of about 4.4, although again other suitable emulsifiers will be apparent to those skilled in the art. It is also preferred that the glycerol monostearate has a residual soap content of about 2% - a residual soap content of 2% has been found to significantly increase the firmness and emulsion stability of the snack bar of the invention when compared with a glycerol monostearate having only a 0.3% residual soap content. It is preferred that the glycerol monostearate be present in an amount of about 4.7% to about 6.9% by weight of the snack bar, more preferably about 5.34% by weight.

It is also particularly preferred that the dietary supplement in this embodiment further includes the following components: fructose (preferably in an amount of about 17.0% to about 22.09% by weight, more preferably 22.09%), glucose syrup (preferably in an amount of about 20.5% to about 21.06% by weight, more preferably 21.06%), whey proteins (preferably Alacen 152 and Alacen 312, in amounts of about 10.0% to about 10.6%, more preferably 10.27%, and about 6.2% to about 6.4%, more preferably 6.37% by weight, respectively), modified starch (preferably in an amount of about 5.0% to about 7.2%, more preferably 6.99%, by weight), water (preferably in an amount of about 3.29% by weight), maltodextrin (preferably Maltrin M100 in an amount of about 2.0% to about 4.4%, more preferably 2.26% by weight), sodium citrate (preferably in an amount of about 0.3% to about 1.0%, more preferably 0.62% by weight), citric acid (preferably in an amount of about 0.2% to about 0.5%, more preferably 0.41% by weight), carrageenan (preferably in an amount of about 0.1% to about 1.0%, more preferably 0.41% by weight), calcium citrate (preferably in an amount of about 0.05% to about 0.16%, more preferably 0.08% by weight), maltol (preferably Veltol, in an amount of about 0.15% by weight) and flavour (preferably vanilla, in an amount of about 0.3% to about 0.8%, more preferably 0.41 % by weight).

The product known as Alacen 312 is a whey protein concentrate that possesses good emulsifying properties. Alacen 152 is a whey protein that will form a firm gel at low temperatures. A typical composition for each of these products is as follows:

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80.0% w/w protein (as is), 5.5% w/w carbohydrate, 5.9% w/w minerals, 4.0% w/w moisture, and 4.6% w/w fat.

5 A preferred modified starch is that known as Avon TB840, which is a thin boiling starch manufactured by acid treatment of refined starch, and having a viscosity (Scott Test 28g) of 40-48 seconds, and a fluidity (cpc), ml of 32-35.

10 Optionally, the high energy dietary supplement in the solid form can include other ingredients which increase bar firmness, such as peanuts, desiccated coconut, oat bran and/or dehydrated potato flakes. It will be appreciated that if such ingredients are added, the amount of partially hydrolysed fat present may need to be adjusted to ensure that at least about 40% of the total energy provided by the dietary supplement is provided by fat.

15

Examples

The present invention is further illustrated by the examples which follow.

20 Example 1

Anhydrous milk fat was heated to 85°C and 0.4% anhydrous sodium hydroxide was added. This was held at 85°C \pm 5°C for 6.5 hours and neutralised to pH 7 with 88% lactic acid. At the completion of hydrolysis, 4.19% of polyoxyethylene-20-sorbitan
25 monostearate was added, at a temperature of not less than 55°C.

The partially hydrolysed milk fat and other dry ingredients were premixed in a ribbon mixer until homogenous. This premix was added to liquid whole milk, homogenised and heat treated using a standard UHT process.

30

The final liquid formulation was as follows:

	<u>Component</u>	<u>% (By Weight)</u>
35	skim milk powder	7.8
	fructose	4.0

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	cocoa	1.45
	whole milk	80.0
	cocoa flavour	0.75
	carboxy methyl cellulose	0.30
5	partially hydrolysed anhydrous milk fat (incorporating emulsifier)	5.1
	sodium citrate	0.60

The above formulation was determined to provide 48.6% of its total energy from fat,
 10 31.4% from carbohydrate and 19.2% from protein.

Example 2

The formulation of the high energy liquid dietary supplement was as follows:
 15

	<u>Component</u>	<u>% By Weight</u>
	maltodextrin (Maltrin M200)	9.0%
	fructose	6.8%
20	milk protein isolate (TMP1180)	5.0%
	sodium citrate	0.4%
	partially hydrolysed milk fat plus emulsifiers	8.8%
	maltol	0.1%
25	flavour	0.4%
	water	69.5%

Method of preparation:

30 Anhydrous milk fat was heated to 85°C and 0.4% anhydrous sodium hydroxide was added. This was held at 82.5°C ±2.5°C for 6.5 hours, then filtered and neutralised to about pH 7.0 with 90% (w/w) lactic acid.

The dry ingredients were premixed and dispersed in water at a temperature of about
 35 80°C. The emulsifier blend (containing 65.2% concentrated medium chain

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triglycerides, 17.4% glycerol monostearate, 13.0% diacetyl tartaric acid ester of mono/diglycerides and 4.3% lecithin) was added to the partially hydrolysed milk fat and heated to 70°C. The fat and emulsifiers were then mixed in with the water phase and homogenised. The maltol and flavour were then added and the mixture was
 5 homogenized and heat treated using a standard UHT process.

Example 3

The high energy dietary supplement, which was in the form of a snack bar, had the
 10 following formulation:

	<u>Component</u>	<u>% (By Weight)</u>
	fructose	about 22.09%
	glucose syrup	about 21.06%
15	partially hydrolysed anhydrous milk fat	about 20.24%
	whey protein (Alacen 152)	about 10.27%
	modified starch (TB840)	about 6.99%
	whey protein (Alacen 312)	about 6.37%
20	glycerol monostearate	about 5.34%
	water	about 3.29%
	maltodextrin (Maltrin M100)	about 2.26%
	sodium citrate	about 0.62%
	citric acid	about 0.41%
25	carrageenan	about 0.41%
	calcium citrate	about 0.08%
	maltol (Veltol)	about 0.15%
	vanilla flavour	about 0.41%

30 Method of preparation:

Anhydrous milk fat was heated to 85°C and 0.4% anhydrous sodium hydroxide was added. This was held at 82.5°C ±2.5°C for 6.5 hours, then filtered and neutralised to about pH 7.0 with 90% (w/w) lactic acid.

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The glucose syrup, partially hydrolysed anhydrous milk fat, glycerol monostearate and water were heated to 70°C. The dry ingredients were premixed, added to the fat mixture and the mixture stirred until the ingredients were mixed in. The mass was

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heated for ten minutes at about 80°C and stirred occasionally. The mass was removed from the heat, the vanilla and maltol added and mixed gently. It was then poured and rolled into a thickness of 1.0 cm. When cold, the mass was cut to a width of 4.2 cm and a length of 12.5 cm.

5

The snack bar was determined (using the Atwater conversion figures) to provide 49.6% of its total energy from fat, 39.4% from carbohydrate and 11% from protein.

10 INDUSTRIAL APPLICABILITY

The Applicants have found that the dietary supplements of the present invention, although providing a relatively high proportion (i.e from about 40% to about 55%) of their energy from fat, are surprisingly palatable and do not cause gastrointestinal distress to endurance athletes. These dietary supplements therefore provide a very concentrated source of energy without the associated disadvantages of traditional high-fat foods. Without wishing to be bound by any theory, it is believed that the partial hydrolysis of the fat exposes a number of hydrophilic groups which facilitates emulsification in the nutritive composition. This in turn facilitates the ease of formulation of the composition into products having a palatable mouth feel and homogenous flavour distribution.

In addition, again without wishing to be bound by any theory, it is believed that the high energy dietary supplements of the present invention have a reduced residence time in the stomach because the fat is already in a partially hydrolysed form, thus reducing the amount of hydrolysis which needs to take place in the stomach. Therefore, the free fatty acids obtained from triglyceride hydrolysis are able to pass more quickly from the stomach to the duodenum, which is where fat digestion occurs. The increased rate of digestion of the fat will give a quick energy boost.

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Also, a problem with non-modified fat is that the long gut residence time has the effect of diverting blood from the muscles, to the stomach, which is liable to cause cramp in endurance athletes. Therefore, reducing the gut residence time of the fat, by using the dietary supplements of the present invention which include partially hydrolysed fat, will have the effect that less blood is diverted from the muscles to the stomach.

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It is therefore believed that the novel high energy dietary supplements of the present invention, which may be in the form of a liquid, a semi-solid or a solid such as a snack

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bar, will find particular acceptance among endurance athletes as a concentrated source of energy which is able to be digested relatively easily.

5 Although the present invention has been described with reference to specific embodiments, those skilled in the art will appreciate that modifications and alterations of the embodiments described may be made without departing from the scope of the invention.

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CLAIMS:

1. A high energy dietary supplement which includes fat which is at least partially
5 hydrolysed and wherein from about 40% to about 55% of the total energy of the
supplement is provided by the fat.
2. A high energy dietary supplement as claimed in claim 1 which includes one or
more non-toxic emulsifiers.
- 10 3. A high energy dietary supplement as claimed in claim 1 or 2 wherein the fat
comprises partially hydrolysed milk fat.
4. A high energy dietary supplement as claimed in claim 3 wherein the milk fat is
15 partially hydrolysed anhydrous milk fat.
5. A high energy dietary supplement as claimed in any one of the preceding claims
which further includes a carbohydrate source, a texture modifier, a sweetener and a
flavouring agent.
- 20 6. A high energy dietary supplement as claimed in any one of the preceding claims,
wherein the supplement is in the form of a liquid.
7. A high energy dietary supplement as claimed in claim 6 wherein the fat source
25 is partially hydrolysed anhydrous milk fat and which includes the following
emulsifiers: monoacetyl and diacetyl tartaric acid ester of mono/diglycerides, glycerol
monostearate, lecithin and concentrated medium chain triglycerides.
8. A high energy dietary supplement as claimed in claim 7 wherein the emulsifiers
30 are present in the following relative amounts: about 65.2% concentrated medium chain
triglycerides, about 17.4% glycerol monostearate, about 13.0% mono and diacetyl
tartaric acid ester of mono/diglycerides and about 4.3% lecithin.
9. A high energy dietary supplement as claimed in claim 8 wherein the emulsifiers
35 are present in a combined amount of about 35.4% by weight of the partially hydrolysed
anhydrous milk fat.

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10. A high energy dietary supplement as claimed in claim 9 wherein the emulsifiers and the partially hydrolysed anhydrous milk fat are present in a combined amount of about 8.8% by weight of the supplement.

5 11. A high energy dietary supplement as claimed in claim 10 which further includes water, maltodextrin, fructose, milk protein isolate, sodium citrate, maltol and a flavouring component.

10 12. A high energy dietary supplement as claimed in claim 11 which has the following formulation:

<u>Component</u>	<u>% By Weight of Total Composition</u>
maltodextrin (Maltrin M200)	about 9.0%
fructose	about 6.8%
15 milk protein isolate (TMP1180)	about 5.0%
sodium citrate	about 0.4%
partially hydrolysed milk fat	
plus emulsifiers	about 8.8%
maltol	about 0.1%
20 flavour	about 0.4%
water	about 69.5%

13. A high energy dietary supplement as claimed in any one of claims 1 to 5 which is in the form of a dry drink base suitable for addition to a liquid to provide a reconstituted drink.

14. A high energy dietary supplement as claimed in claim 13 which has been prepared by spray drying a liquid high energy dietary supplement as claimed in any one of claims 6 to 12.

30 15. A high energy dietary supplement as claimed in any one of claims 1 to 5, wherein the supplement is in the form of a snack bar.

16. A high energy dietary supplement as claimed in claim 15, wherein the fat source is partially hydrolysed anhydrous milk fat and which includes glycerol monostearate as emulsifier.

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17. A high energy dietary supplement as claimed in claim 16, wherein the glycerol monostearate has a residual soap content of about 2%.

18. A high energy dietary supplement as claimed in claim 17, wherein the glycerol monostearate is present in an amount of about 26.4% by weight of the partially hydrolysed anhydrous milk fat.

19. A high energy dietary supplement as claimed in any one of claims 16 to 18, wherein the partially hydrolysed anhydrous milk fat is present in an amount of about 20.24% by weight of the snack bar.

20. A high energy dietary supplement as claimed in any one of claims 16 to 19, which further includes the following components: fructose, glucose syrup, whey proteins, modified starch, water, maltodextrin, sodium citrate, citric acid, carrageenan, calcium citrate, maltol and flavour.

21. A high energy dietary supplement as claimed in claim 20 which comprises the following components in the proportions set out below:

	<u>Component</u>	<u>% (By Weight)</u>
20	fructose	about 17.0% to about 22.09%
	glucose syrup	about 20.5% to about 21.06%
	partially hydrolysed anhydrous milk fat	about 20.24%
25	whey protein (Alacen 152)	about 10.0% to about 10.6%
	modified starch (TB 840)	about 5.0% to about 7.2%
	whey protein (Alacen 312)	about 6.2% to about 6.4%
	glycerol monostearate	about 4.7% to about 6.9%
	water	about 3.29%
30	maltodextrin (Maltrin M100)	about 2.0% to about 4.4%
	sodium citrate	about 0.3% to about 1.0%
	citric acid	about 0.2% to about 0.5%
	carrageenan	about 0.1% to about 1.0%
	maltol (Veltol)	about 0.15%
35	calcium citrate	about 0.05% to 0.16%
	vanilla flavour	about 0.3% to about 0.8%.

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22. A high energy dietary supplement as claimed in claim 21 which has the following formulation:

	<u>Component</u>	<u>% (By Weight)</u>
5	fructose	about 22.09%
	glucose syrup	about 21.06%
	partially hydrolysed anhydrous milk fat	about 20.24%
	whey protein (Alacen 152)	about 10.27%
10	modified starch (TB 840)	about 6.99%
	whey protein (Alacen 312)	about 6.37%
	glycerol monostearate	about 5.34%
	water	about 3.29%
	maltodextrin (Maltrin M100)	about 2.26%
15	sodium citrate	about 0.62%
	citric acid	about 0.41%
	carrageenan	about 0.41%
	maltol (Veltol)	about 0.15%
	calcium citrate	about 0.08%
20	vanilla flavour	about 0.41%.

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